XTAL SET SOCIETY

Books, Kits, Parts

YOUR SEPTEMBER 2014 NEWSLETTER IS ENCLOSED

GETTING BACK TO BASICS

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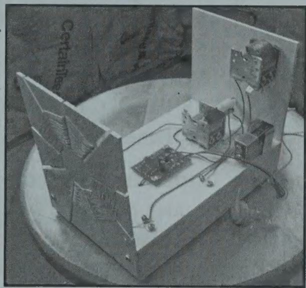
Spider Web Radio Kit

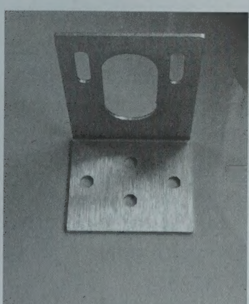


This kit features a spider web coil, infinite impedance detector on a 1.5 by 2 inch PCB, two variable capacitors - one for station tuning and one for antenna tuning - and ABS low-loss coil form, chassis, and front panel. The set produces good volume and low distortion audio compared with most crystal sets. Parts are selected to cover the AM broadcast band. The set expects to see a 40 to 50 foot end fed wire antenna and earth ground.

The set comes with 60 feet of #22 enamel wire for the spider coil. You can purchase 150/46 Litz wire if you like, which we stock on our parts page and will boost the coil Q a bit. The kit manual is 12 pages in length and includes information on winding spider web coils. Two mechanical drawings - to scale - are also provides as templates for the holes you will drill in the ABS chassis and front panel, requiring 5/32 and 1/4 bits you'll supply. Two larger holes for the variable caps are punched for you ahead of time. The spider web coil form is fully drilled and slotted as indicated in the picture. SpCo Radio $69.95

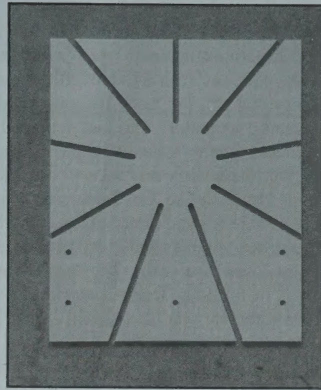
365 L-Bracket

The Vertical 365 Mounting bracket will allow you to mount the cap above the chassis platform and away from the front panel.



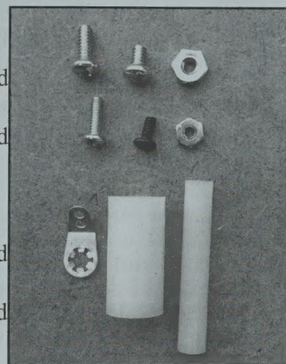
Holes at the bottom of this L-shaped bracket can be used to mount to the chassis; and, the two small vertical slots are provided for 6-32 by 1/4 screws to secure the cap to the bracket. Adjust height as desired. **Please note that the dimensions of this 365 Vertical Bracket are NOT the same as those for the Reduction Drive bracket.** Cat# 365-L $2.95.

Spider Coil Form



This 5 by 6 by 1/8th inch ABS plastic form includes nine NC punched radial slots and five mounting holes. The inner diameter is 1.6 inches and the outer diameter extends to the edge of the form, 5.0 inches. This size supports 250 uH coils (good for the AM band) when used with #22 or #26 enamel, or 150/45 Litz wire using 56 turns of 150/45 Litz, with a 1.6 inner diameter and 4.2 outer diameter. Weight of the form itself is 2 oz. An instruction sheet including formula and table ships with the form. In addition, you'll find the spider formulas for number of turns for a given inductance on our formulas-calculators web page on our main site, www.midnightscience.com #22 and #26 enamel coated wire and 150/46 Litz wire are also listed on our parts page on the web. Spider Coil Form Cat #SpCO $9.95 each.

Connector Assortment



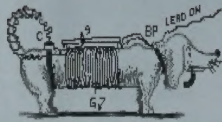
The assortment includes:

6, 6-32x3/8 inch Phillips-head screws,
6, 6-32x1/4 inch Phillips-head screws,
12, 6-32 hex nuts for the above,
6, 4-40x3/8 inch Phillips-head screws,
6, 4-40x1/4 inch Phillips-head screws,
12, 4-40 hex nuts for the above,
6, #6 solder lugs,
2, 1-inch by ½ nylon shafts with interior ¼ inch opening,
2, 1.5-inch by ¼ nylon shafts.

You can use a screw, solder lug, and hex nut to provide a ground connection on the frame and rotor plates of our air variable capacitors. You can use a pair of the nylon shafts by drilling and tapping two holes in the larger shaft for interconnection with the cap shaft and the smaller nylon extender. This enables you to mount the cap away from the front panel.

Cat# Connect assort 3.95

THE XTAL SET SOCIETY



e-mail: xtalset@sunflower.com

We are dedicated to once again building and experimenting with radio electronics, often—but not always—through the use of the crystal set, the basis for most modern day radio apparatus. This newsletter helps support our goal of producing excellent quality technical books that encourage learning and building. To join the society and receive one year of the bi-monthly newsletter, remit $14.95 to The Xtal Set Society. Canadians, please remit US $15.95. Outside the US and Canada please remit US $21.95.

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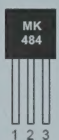
Editor & Queen Mum- Patricia, NØGZZ
Columnist- J.K. Fenton
Columnist- Dan Petersen, W7OIL

MK-484 TRF AM Radio Chip in TO-92 Pack

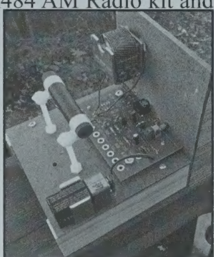
The MK484 is an offshoot of the famous Ferranti ZN-414 and is a tuned radio frequency (TRF) radio in a small TO-92 transistor-like package. Combined with (these parts not included) three resistors, three capacitors, an ear phone, 1.5V battery, tuning coil and tuning capacitor, you can make an AM receiver for the AM band and up to 3 MHz. See our article in the July issue of our newsletter for a circuit example with details. Suggested schematic with parts list sent with each IC (chip). Cat# XSMK $2.49



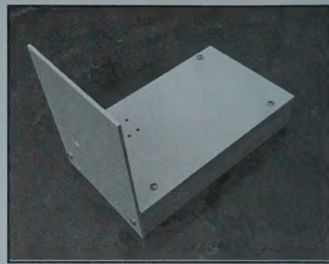
Mini MK484 Radio Kit

No antenna or ground required!

This "mini" kit is a subset of the MK484 AM Radio kit and uses a small portion of the printed circuit board of that kit. The MINI features the MK484 IC, a ferrite rod antenna, a 1.5 volt regulator, a handful of resistors and capacitors, an on-off switch, variable capacitor, panel, chassis, and crystal radio earpiece. The set does not need an antenna or ground since it includes the ferrite rod; does not need a volume control since it has built in gain control, and the earpiece takes the place of headphones. You supply the 9V battery. The radio is set to tune the AM band. MK484 mini $69.95



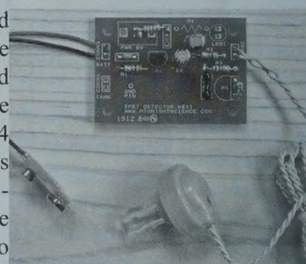
ABS Panel and Chassis Kit



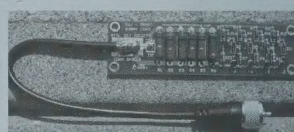
This kit, includes two precut ABS (low-loss) panels, 5 x 6 x 1/8 and 5 x 8 x 1/8th inches; two wood rails each 1.5 by ¾ by 8 inches long, and six wood screws. No holes are predrilled in the panels or rails. The kit includes mechanical drawings showing dimensions and locations for the holes, including drill-hole patterns for the shaft and mounting of our 365 air variable capacitors. ABS Panel Assembly Kit, Cat #ABSPAK, $9.95.

5x6x1/8 ABS Panel, Cat#ABS6 $ 3.95
5x8x1/8 ABS Panel, Cat#ABS8 $ 3.95

Infinite Impedance Detector Kit



This kit includes parts and a small PCB to substitute a JFET circuit configured as an infinite impedance detector for the usual 1N34 diode detector. With this replacement, your crystal set will generate more volume and reduce audio distortion. Historically this arrangement was used with a triode tube in early AM radio sets. Ideal for those wishing to listen to AM with improved audio linearity. Kit replaces the diode detector in your crystal or TRF set. Assembly time is about one-half hour. CAT # XSIDK $19.95.



XS-SDLK (Self Powered) Smart Dummary Load- 10 Watts.

For QRP Amateur Radio use. This kit and our passive CW filter kit were inspired by our enthusiasm for non-powered - no batteries - electronics. The "smart" dummy load, assembled on a 1-1/4 by 4-1/2 inch PCB, features a 10-watt dummy load with power levels achieved denoted by four LEDs. The circuit includes six 3-watt metal film resistors, four detector diodes, four zeners, four LEDs, and bias resistors. The four LED circuits denote power achieved: 1, 2, 5, or 10-watts. *The signal measured supplies the power.* No batteries Mom! Assembly time is about 25 minutes. Coax with PL-259 connector not included. XS-SDLK , $19.95.

The Xtal Set Society Newsletter

Volumn 24, No.4 September 2014

In this issue (#139 September 2014)

The Crystals of "Crystal Radio"

BY HP Friedrichs, AC7ZL

"Crystal Radio." The very term for this technology contains, embedded within it, reference to the iconic material responsible for extracting intelligence from the waves in the aether—the detector crystal. Sadly, it seems that most contemporary crystal set builders interpret this word to mean a factory-made 1N34 germanium diode. Even among adventuresome builders, those who might craft their own crystal cups and cat's whisker mechanisms, rarely is attention paid to natural detector materials outside of galena.

In truth, there is a wide variety of metallic minerals that exhibit useful electrical properties, and in the early days of radio many of them were pressed into service.

What is a crystal detector? In essence, it is a primitive semiconductor, not unlike the silicon or germanium-based diodes found in modern electronics, except that they are usually comprised of naturally-occurring—as opposed to human-engineered—materials. Detector behavior emerges when pairs of materials, two different types of crystal for example, or a crystal and a wire probe, are brought into intimate contact. A complete detector includes not only the raw materials just mentioned, but some kind of adjustable mechanical contrivance used to position and hold the semi-conducting materials against one another.

So which naturally-occurring materials make for a good detector? Table 1 contains a list of possible candidates that I've assembled. The list is by no means exhaustive, but it does draw from multiple sources including the October 1925 edition of J.F. Corrigan's *Crystal Experimenter's Handbook*, Ralph Stranger's 1928 work *Wireless The Modern Magic Carpet*, Alfred Morgan's 1913 *Wireless Telegraph Construction for Amateurs*, Chris Pellant's 1992 *Rocks and Minerals*, and assorted books and materials from my personal library.

The first column in the table contains the names of various mineral types. Note that some minerals are known by more than one name, and if I could determine that, I included references to both. I did not acknowledge period references to "inserite," "tserine," or "iserine" because, frankly, I could find no mention of them in any of the more modern books that I have. As I am not a geologist, I'll accept fault for their exclusion. Maybe these particular names are no longer in vogue or the substances in question are now known by different, newer names.

Some substances were flagged by Corrigan as being commercially successful detector materials. These I've signified in the table with a bold font.

The next three columns tell us something about the chemical composition of each mineral. Column two provides a chemical name, column three specifies a chemical formula, and column four classifies the compound. In extracting data from period sources I noticed that some of the chemical information was in minor disagreement with more modern sources. In those cases, I defaulted to the more recent data.

Column five is of particular interest, because it says something about what combinations of materials will result in useful detectors. This information was taken primarily from Corrigan.

Column six reflects specific references to minerals made by Corrigan in his *Crystal Experimenter's Handbook*, mentioned earlier. An "X" appears in the row of any mineral described by that book. Column seven reflects the recommendations of a Dr. D.H. Eccles who is quoted in Stranger's *Magic Carpet*. Column eight represents the recommendations of Japanese scientist Wichi Torricata whose comments were published in the September 16, 1910 edition of *Electrician*. The *Electrician* piece, incidentally, is also cited in Stranger's book. Column nine represents references in Alfred Morgan's work.

It comes as no surprise that galena is on the list, and is endorsed by four authors. Because my own experience with galena detectors involves crystals probed with the classic wire "cat's whisker," it was interesting to discover that a galena detector can also be built with galena-on-galena, silicon-on-galena, and graphite-on-galena. In the latter case, I can envision probing the galena crystal with a soft (low clay content) #1, #2 or B-grade pencil lead.

My favorite whisker material for galena is phosphor bronze wire. As a guitar player, I enjoy a ready supply of phosphor bronze wire in the form of used acoustic guitar strings. In guitar strings, the bronze wire is wound around a core of steel music wire to thicken the string and reduce its pitch, generally the low "E," "A," and "D" strings. Extraction of the bronze wire involves no more than unwrapping a segment of guitar string to remove whatever length of bronze wire is needed.

Speaking of pencil leads, any crystal radio builder worth his salt has heard of the so-called "foxhole" radio. First described in the July 1944 issue of QST magazine, the foxhole radio was a primitive crystal receiver devised by clever soldiers stationed on the Anzio beachhead. Their detector was comprised of a blued razor blade probed by a piece of pencil lead. Chemically speaking, the bluing is a form of magnetite and pencil lead is, of course, predominantly graphite. Both of these materials are represented in Table 1.

Also to be expected, iron pyrites appear in the table. Iron pyrite, or "fool's gold" is a readily-available and cheap mineral to purchase and play with. I have found that while not all samples make effective detectors, most do. My favorite configuration involves the pyrite crystal probed with a steel wire whisker. Music wire with its high carbon content is nice and springy, and can also be harvested from guitar strings (I suggest the 0.008-0.010-inch high "E" strings). I provide detailed plans for a pyrite detector in Chapter 11 of my book, *The Voice of the Crystal*.

Another detector material that I have some experience with, which appears in Table 1, is cuprous oxide. I've written extensively on experiments with this substance in my book *Instruments of Amplification*, and my article "Fun With Homebrew Cuprous Oxide Diodes" which appeared in the January 2010 issue of the *Xtal Set Society Newsletter*. The mineral form of cuprous oxide is called cuprite. In the case of my experiments, the oxide I used was created artificially on the surface of carefully-prepared samples of copper metal.

Table 1 suggests tellurium and antimony as suitable contacts for use with cuprite. Homegrown cuprous oxide films, however, are fragile and are subject to unintentional scratches or penetration. Thus, my favorite probe material for cuprous oxide is metallic lead or solder. Unlike harder metals like bronze or steel, lead is soft and compliant. As well, I've experimented with tiny beads of indium and even dots of silver-bearing ink. All work well as contact materials. Though I haven't tried it, graphite might be worth a look.

Given my own success with copper oxides, I find chalcocite, or copper sulfide, an intriguing variation. I've never played with chalcocite, but Corrigan's handbook describes a technique for making your own copper sulfide detector.

One must carefully melt a small quantity of sulfur until it's fully liquefied. The end of a copper rod, previously cleaned and polished to a bright shine with emery paper, is immersed in the liquid for several minutes, and then withdrawn. Finally, the coated end of the rod is ignited, and any free sulfur that remains is allowed to burn off. Corrigan reports that the coating thus formed works well in contact with zincite, or even when probed by the usual cat's whisker. The author does not mention what I feel I must: Such preparations will surely result in the production of toxic fumes, so experiments like this should be conducted outdoors, and then only while

wearing suitable protective gear like leather gloves and safety glasses.

If one mineral can be said to dominate Table 1, that would be zincite. Zincite, it seems, will produce a useful detector junction with just about everything else. Zincite in contact with a copper pyrite crystals form the basis of G.W. Pickard's legendary "Perikon" detector.

Zincite has the additional property that, if stimulated properly, it can be induced to both amplify and to oscillate-- the very properties that make modern transistors so useful. It is a pity that much of the interest in crystal oscillators vanished when practical vacuum tubes first appeared. However, contemporary experimenters like Nyle Steiner have rediscovered and written about this phenomenon.

Given the random processes responsible for natural crystal formation, the specific chemical content of a given mineral type is subject to variability imposed by the whims of nature and chance. For example, if foreign substances are present when minerals are being formed, those compounds may be integrated into the emerging crystals, thus modifying their physical properties. In crystal radio terms, this can result in the non-responsive or "dead" detector mineral that early radio enthusiasts occasionally grumbled about. However, sometimes the type and concentration of the adulterants is such that they actually enhance the signal-detecting properties of the crystal. Two examples of this readily come to mind.

Galena, chemically speaking, is a lead sulfide. However, my readings suggest that the best galena for crystal radio detectors is not pure, but a type which contains trace amounts of silver. This latter type of galena, called argentiferous galena, is said to produce superior detectors, both in sensitivity and stability.

Another example is zincite. Zincite is a simple oxide of the metal zinc. Pure synthetic zincite crystals are typically clear and colorless, but from what I've gathered, the zincite with the most desirable radio properties is red. This red color manifests itself in the zincite crystals because they've been naturally tainted with manganese and iron.

Incidentally, modern semiconductor manufacturers make routine use of contaminants in their products, albeit in an intentional and carefully-controlled manner. The purpose of this is to beneficially alter the electrical properties of the materials from which transistors and integrated circuits are made. The industry calls this practice doping.

A complete list of naturally-occurring detector materials would far exceed the contents of Table 1. However, when it comes time to apply these materials to an actual radio receiver, certain practical considerations immediately shrink the size of any pool of candidates.

For example, some minerals are comparatively rare or exhibit detrimental chemical properties. Despite Torricata's endorsement, syvanite is a good example of both. It is a fairly rare crystal which tends to makes it very pricey. Then, some instances of sylvanite are actually photosensitive and will tarnish upon exposure to light.

An ideal detector should be easy to adjust and set into action. Once set, the detector should remain functional over a useful interval of time. Yet, success with many natural detector materials depends upon the pressure with which the crystals are probed. Some require robust pressure between crystals or the crystal and its whisker. Other detector materials will function with the slightest touch. Some are so sensitive to mechanical shock that it's difficult to get them properly adjusted, and once so, a hard stare is sufficient to knock them out of whack. Despite otherwise useful properties, such unstable materials will result in a detector that is more trouble than it's worth.

It is best if a detector is "sensitive." Sensitivity is a consequence of the voltage that must be applied to the crystal in order to get it to conduct, and the rate at which current through the crystal rises with further increases in applied signal. Why is this important? Because if we attempt to detect a radio signal whose amplitude lies below the threshold of conduction for the detector, the detector will remain in an "off" condition and the signal will not be heard.

Let's talk about carborundum in the context of these last few paragraphs. Carborundum is a synthetic industrial

abrasive. It doesn't have to be mined, and there is no shortage of it because it's easy to make. Consequently, carborundum is relatively easy to obtain and its price is reasonable.

Carborundum is normally probed with steel, another common material. Carborundum likes firm contact between itself and the steel probe, which lends itself to the construction of mechanically stable detectors. Once adjusted, a carborundum detector tends to stay properly adjusted for a long time.

Regrettably, carborundum is not a very radio-sensitive material. Whereas a galena detector or a germanium diode like the 1N34 will begin conducting signals as small as a few tenths of a volt in amplitude, a carborundum detector will not function properly until the applied signal reaches a volt or more—a tenfold reduction in comparative sensitivity—which renders it useless for weak-signal work. Figure 1 is a graph adapted from Bucher showing the response curve for a typical carborundum crystal. Given this apparent lack of sensitivity, why is carborundum bolded in Table 1, signifying it as a commercially successful detector material?

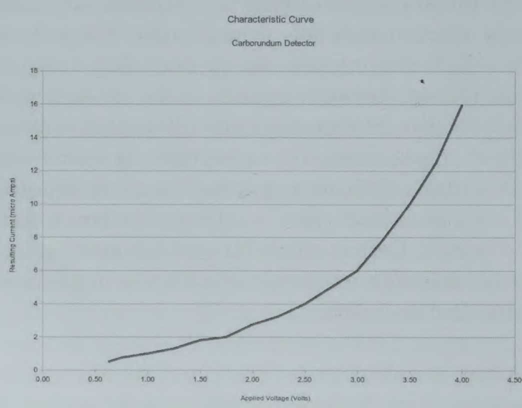


Figure 1

It turns out that carborundum's problems can be mitigated through the careful application of what is called a "bias voltage." The idea is to use a small battery to apply an electrical potential on the detector that is almost, but not quite, sufficient to force it into conduction. Operating the crystal in this manner means that a radio signal superimposed on the bias, even a very tiny signal, will then be sufficient to trip the crystal into conduction. It should be understood that the same technique can be applied to other detectors to varying degrees of advantage.

Figure 2 depicts a simple crystal receiver with an option to bias its detector. The circuit was adopted from the Marconi Model 107A Tuner.

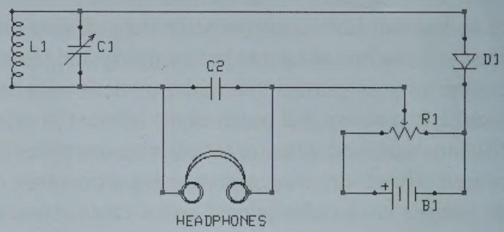


Figure 2

The biasing circuitry consists of nothing more than a couple of dry cells in series (B1) and a potentiometer (variable resistor, R1). When the potentiometer is at its lowest setting (to the far right), battery current flows through the potentiometer only. No potential is applied to the detector (D1). As the potentiometer is advanced to the left, however, an increasing voltage will be applied to the detector through a circuit completed by the headphones and tuning coil (L1). Figures 3, 4, and 5 depict minor variation on this basic idea.

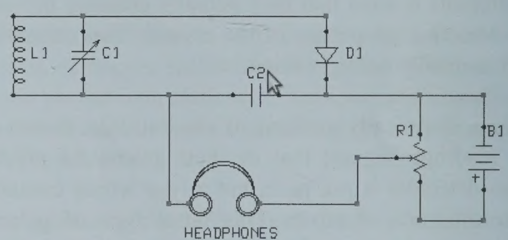


Figure 3

What is the correct point of adjustment? That depends upon the detector materials in use and is best determined through trial and error. Too much bias will render a detector as deaf as no bias at all. Note also that it is possible to bias a detector in the wrong direction. If advancing the potentiometer does not result in increased sensitivity, the battery terminals should be swapped, so as to reverse the polarity of the bias volt-

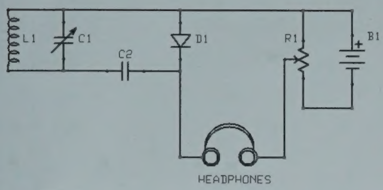


Figure 4

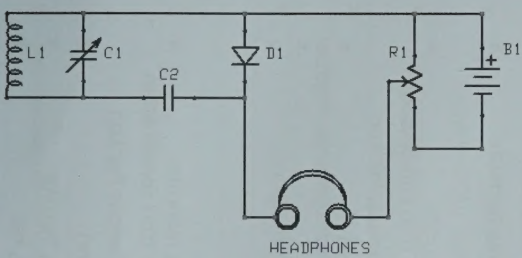


Figure 5

age. The circuit shown in Figure 5 is interesting in this context, because it is capable of applying either a positive or negative bias, of varying magnitude, without rewiring the battery.

Where can one find samples of minerals to experiment with? I checked the phone directory listings for a half-dozen major cities in the United States, and each revealed several rock and mineral shops where detector materials might be purchased. If brick-and-mortar shops are not your cup of tea, minerals are offered for sale through numerous Internet retailers including giants like Amazon and Ebay.

A Google search of the phrase "minerals for sale" yields more than ten million hits. In this day and age, the Internet may be the best place to begin any search of this type.

I am fortunate to live in Tucson, Arizona, host of the annual International Gem and Mineral Show. Each year, hundreds of vendors converge on our city to offer for sale a staggering variety of mineral specimens, collected from the four corners of the earth. This event takes place between mid-January and mid-February of each year. If you happen to be the inhabitant of a state or province that is normally snow-bound at that time of year, the search for radio detector minerals can provide a wonderful excuse to visit and enjoy Tucson's warmth and hospitality.

If all else fails, poke around in the dirt in your backyard, at the park, a hiking trail, or on the beach. You might be surprised what you find.

Below is a list of some of the information sources cited in this article. I also invite you to visit my website at: www.hpfriedrichs.com

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Useful Primitive Radio Detector Minerals

Mineral	Chemical Composition	Chemical Formula	Crystal Category	Suitable Contacts	PW (1925)	Eccles (1928)	Toricata (1910)	Morgan (1913)
Allemontite	Arsenic antimonide	AsSb	Antimonide				x	
Anatase	Titanium dioxide	TiO2	Oxide	Metals and Zincite	x		x	
Antimony	Element	Sb	Element	Zincite, silicon, etc.	x			
Argentite (silver glance)	Silver sulfide	Ag2S	Sulfide	Metals, graphite, tellurium	x			
Arkansite	See Anatase						x	
Arsenic	Element	As	Element	Metals and Zincite	x	x	x	
Arsenic pyrites	See Mispickel						x	
Bornite (peacock ore)	Sulfide of copper and iron	Cu5FeS4	Sulfide	Zincite, silicon, etc.	x	x	x	x
Boron	Element	B	Element	Zincite, tellurium	x	x		
Boulangerite	Sulfide of antimony and lead	Pb5Sb4S11	Sulfosalt				x	
Bourmonite	Sulfide of copper, antimony and lead	PbCuSbS3	Sulfosalt	Zincite, tellurium, antimony, bismuth	x			
Brookite	See Anatase					x		x
Carborundum	Silicon Carbide	SiC		Steel, zincite	x			
Chalcopyrite	Sulfide of iron and copper	CuFeS2	Sulfide	Zincite (this combination is the famous Perikon detector)	x	x		x
Cobaltite	Cobalt arsenic sulfide	CoAsS		Zincite	x		x	
Cassiterite	Tin Oxide	SnO2	Oxide	Metals	x		x	
Cerussite	Lead Carbonate	PbCo3	Carbonate	?		x		
Chalcocite (copper glance)	Copper sulfide	Cu2S	Sulfide	Zincite, tellurium	x	x	x	
Copper pyrites	Sulfide of iron and copper	CuFeS2	Sulfide	Zincite (this combination is the famous Perikon detector)	x		x	
Corundum	Aluminum oxidde	Al2O3	Oxide	Zincite, bornite	x			
Covellite	Copper sulfide	CuS	Sulfide	Zincite, etc	x		x	

Mineral	Chemical Composition	Chemical Formula	Crystal Category	Suitable Contacts	PW (1925)	Eccles (1928)	Toricata (1910)	Morgan (1913)
Cuprite (Cuprous oxide)	Copper oxide	Cu_2O	Oxide	Tellurium, antimony, etc	x	x		
Domeykite	Copper arsenide	Cu_3As	Arsenide				x	x
Enargite	Sulfide of copper and arsenic	Cu_3AsS_4	Sulfosalt				x	
Erubescite	See Bornite				x			
Frieslebenite	Sulfide of antimony, silver, and lead	$PbAgSbS_3$ (compositon varies)	Sulfide	Zincite, silicon	x			
Galena	Lead sulfide	PbS	Sulfide	Metals, graphite, galena, silicon	x	x	x	x
Graphite	Element	C	Element	Zincite, galena, molybendite, silicon	x	x	x	
Hematite	Iron Oxide	Fe_2O_3	Oxide	Zincite, most sulfide materials	x			
Hessite	Telluride of silver or gold							x
Hystatite	See Ilmenite						x	
Ilmenite	Oxide of iron and titanium	$FeTiO_3$	Oxide	Metals, silicon	x		x	
Iridosmine	Native alloy of iridium and osmium	Composition varies	Alloy				x	
Iserine	See Ilmenite						x	
Iron Pyrites	Iron sulfide	FeS_2	Sulfide	Metals, silicon, zincite, tellurium	x	x	x	x
Lolingite	Iron arsenide	$FeAs_2$ plus other metals	Arsenide				x	
Magnetite	Magnetic iron oxide	Fe_3O_4	Oxide	Silicon, carbon, etc	x		x	
Marcasite	Iron sulfide (containing arsenic)	FeS_2 with As	Sulfide	Similar to iron pyrites	x		x	
Melaconite	See Tenorite						x	
Meteorite	Iron/Nickel mixture	Compositon varies	Alloy				x	
Mispickel	Sulfide of iron and arsenic	$FeAsS_2$	Sulfide	Similar to iron pyrites	x			

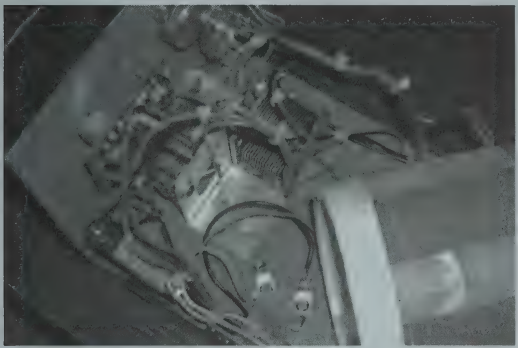
Mineral	Chemical Composition	Chemical Formula	Crystal Category	Suitable Contacts	PW (1925)	Eccles (1928)	Toricata (1910)	Morgan (1913)
Molybdenite	Molybdenum sulfide	MoS2	Sulfide	Silver, graphite	x	x	x	x
Nagyagite		Pb5A(Te,Sb)4 S5-8)	Sulfosalt				x	
Niccolite	Nickel arsenide	NiAs	Arsenide				x	x
Octahedrite	See Anatase				x			x
Plattnerite	Lead peroxide	PbO2	Oxide	Lead				x
Psilomelane	Manganese oxide	Mn2O3H2O	Oxide	Zincite, metals	x	x	x	
Pyrolusite	Manganese dioxide	MnO2	Oxide	Zincite, metals	x		x	
Pyrrhotite	See Iron Pyrites				x		x	
Schwatzitge	Compound of copper, lead, antimony and arsenic	Composition varies					x	
Siegenite	Nickel cobalt sulfide	(Ni,Co)3S4	Sulfide				x	
Silicon	Element	Si	Element	Metals, zincite, iron pyrites, etc	x	x		x
Smaltine (Smaltite)	Arsenide of cobalt, iron and nickel	(Co,Fe,Ni)As2	Arsenide	?		x	x	
Stannite	Mixture of iron, copper, and tin sulfides	Composition varies	Sulfide	Zincite, etc	x			
Stibnite	Antimony sulfide	Sb2S3	Sulfide	Zincite, etc	x			x
Stromeyerite	Sulfide of copper and silver	CuAgS	Sulfide	Zincite and some metals	x			
Strutterudite	Cobalt arsenide with nickel and iron	(Co,Ni,Fe)As3	Arsenide				x	
Sylvanite	Silver gold telluride	(Ag,Au)Te2	Telluride				x	
Tantalum	Element	Ta	Element	Mercury				x
Tellurium	Element	Te	Element	Zincite, aluminum, silicon	x	x		
Tennantie	Sulfide of copper iron and arsenic	(Cu,Fe)12As4 S13	Sulfosalt				x	
Tenorite (Copper Oxide)	Copper oxide	CuO	Oxide				x	
Tin pyrites	See Stannite							
Ullmanite	Nickel arsenic sulfide	NiAsS	Sulfide				x	
Wad	Manganese oxides or hydroxides	Composition varies	Oxide or hydroxide				x	
Zinc blende (sphalerite)	Sulfide of zinc and iron	(Zn,Fe)S	Sulfide				x	
Zincite	Zinc oxide, containing manganese	ZnO	Oxide	Almost any contact	x	x	x	x

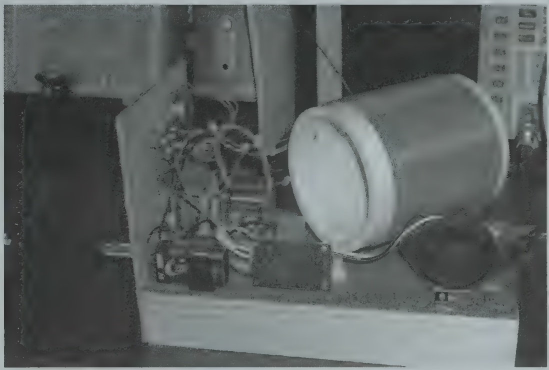
[Editor: In the July issue, Chip Olheiser, W7AIT, presented his modifications to the JFET radio. Here he presents another version using an external antenna]

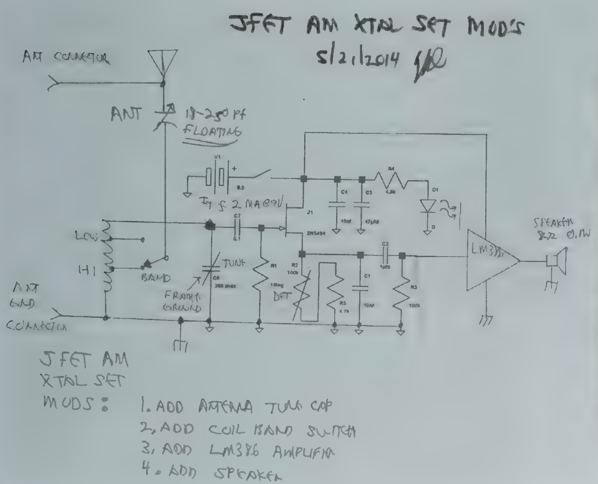
More Modifications To My JFET XTAL Set.

1. Add antenna tune trimmer capacitor
2. Add coil band switch
3. Add lm386 audio amplifier
4. Add speaker

See schematic and pictures.



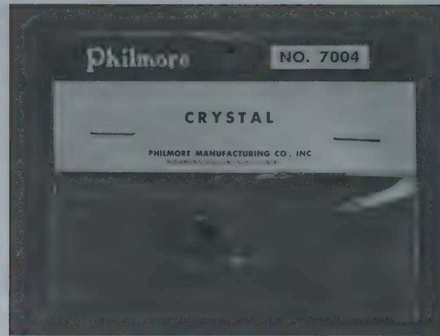




Occasionally in our coming and going, we come across some special items. These Philmore and Calrad items were found on such a trip.

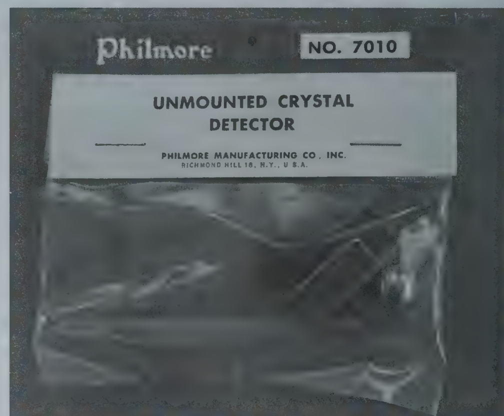
Mounted Galena - Philmore 7004

The Philmore 7004 is a single mounted galena crystal; that is, the galena rock is set in a disc of woods metal. The disc fits in our brass cup holder found on our parts page. It also fits in a cup included in the Philmore 7010 Unmounted Galena Detector; see the next item. **Mounted Galena Philmore $4.95**



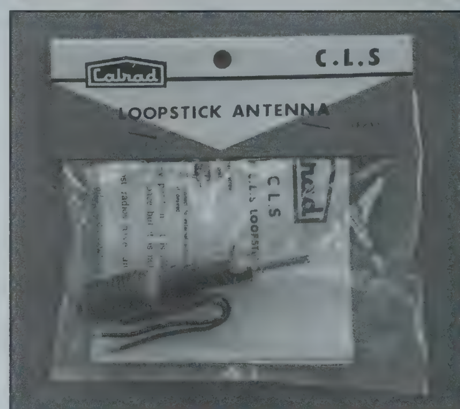
Unmounted Crystal Detector Philmore 7010

The Philmore 7010 is an unassembled (unmounted) crystal detector kit. While a bit hard to see in the package, it consists of a handle on a rod, a cat whisker, a ball joint and U-shaped holder for the ball and rod, with screw and nut. **Unmounted Crystal Detector Philmore $5.95**



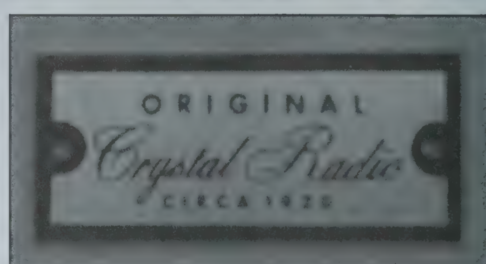
Loopstick Antenna Calrad

This item consists of a ferrite rod with two coils wound on top of a tube holding the rod. The inner winding consists of Hi-Q Litz wire and the outer coil consists of a few turns; it connects to your station antenna and ground. The inductance of the loopstick is adjustable, using the screw at the bottom or with a non-metalic screw driver at the top opening. Set to the center, the rod is resonant at 1000 kHz in the medium wave band, i.e. the AM band. This was an extremely popular item in the 1950s. The loopstick may be mounted by drilling a 3/8th inch hole in a chassis. Simply press the "pound nut" (screw end of the rod) into the chassis. We tried one with our imfinite impedance detector kit and it worked nicely. **Loopstick Antenna Calrad $4.95**



Crystal Radio Plate

We also found these 3/4 by 1-3/4 inch nice radio "Plates" in the bottom of one of the boxes of stuff. The plates are 25 mils thick and can be mounted with small brads (nails) on a panel. The lettering is printed in black on the brass surface. **Crystal Radio Plate $1.50**



[See earphone on page 12]

Xtal Corner: Member correspondence

Good evening Patricia,
Please find attached a photo of our Scouts with their completed crystal radios and Morse keys. The project was a lot of hard work but also a lot of fun. Regards,
Evan

Hello,
Your opening website notes apply to me as well. Years ago (mid 60's) I had a week to kill in Manila. I stayed with a friend who owned a radio and TV manufacturing plant. I puttered in his lab and I had the materials and the time to explore an idea. He had lots of ferrite rods and Litz wire and I built a crystal set with a transistor amplifier. I wanted to have the design operate without any additional power so I built two crystal sets. One was Hi Q optimized for a local radio station which was rectified to provide the power for the transistor. The other set was used normally. It worked very well. One crystal set powered the other. The heart of a crystal set is the quality of the coils and the efficiency of the detector.

With so many very low power RF IC's available today this idea could be improved/ modernized. Is this an idea that has been explored by your members?
X < > Y,
Richard J. Nelson
Richard Nelson
Consulting Technical
Editor ***HP Solve***

Hello Richard. Nice to hear from you.
Yes; this concept/idea has been circulating in crystal set circles for many years. You'll find various implementations in a number of our past newsletters, dating back to 1991. We have a list of our articles on the downloads page of our website, www.midnightscience.com . I suspect you'll find many more examples via Google searches. We'd welcome another article for our newsletter if you wish to submit one. Nice to meet you. Phil Anderson

Folks,
Thanks for the spider web coil theory discussion in your January issue. The revised Wheeler formulas interest me very much. If you republish this information, please add that variable "A" stands for the average diameter of the windings. (I found variable "A" on the Web.) The "A" definition also seems to be missing from the page 4 article.

8-29-14

If you republish the table on the bottom of page 6, please add the variables from your equations. They'd fit in an extra row below row "#26." Running left to right: D1, N, w, s, D0, ? LuH and ?

Maybe the two question marks should be Len" and Len', or just "Inch" and "Ft."

You don't show the equation for length. For inches, would that be Len"= [(N * A) * pi]? . James T. Hawes AA9DT

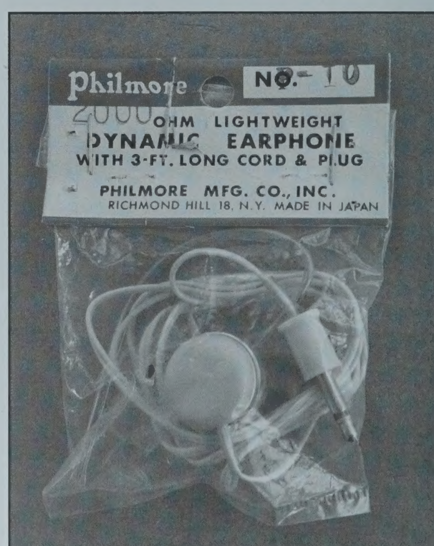
Thanks for the good suggestions James. We've added them to a file you can upload via the parts page in our spider section.

Hi Folks
Having a lot of 18 AWG copper wire on hand and being bored without many projects to do, would I be wasting my time making a whopper spider coil to use as a directional antenna? I have the lid off a 5 gallon plastic bucket that is a foot across to make the form with, or would I use the Tinker toy type spoke wheel, maybe with 11 spokes?

I'm not expecting much from it, and it'll probably end up as a clever storage spool for the wire. It won't be the first time this happens.

Could a basket weave work for this gizmo? I haven't ever (I think) seen either one used for this purpose, most of them being used for variometer and circuit coils. The basket weave would act more like a loop antenna though. And how about those pancake coils mounted to the inside of early tube portable radio back covers? I don't have one to look at but I assume they were antenna supplements to the telescoping type antennas. John Plante Thanxtel

John. The old loop antennas found on the back of old AM radios are certainly directional. I'd try that one. They act similar to a coil-ferrite rod combination. The spider coil is wound on a flat surface, similar to the old loop antennas wound and mounted on the back of the radio cabinet. You could go that way too. If you have lots of wire, consider winding two loops and then you can couple the antenna loop to the radio loop and adjust their distance and angle to improve selectivity. Phil.



Detectors, Amplifiers, Headphones, and More: The Broad Reach of Crystal Radio, Volumes 14 & 15 of the Xtal Set Society Newsletter

Once again society members bring you ideas and instructions for a variety of crystal radio projects. This book contains projects and theory about crystal radio including: The Magic Reynolds Wrap Attic Antenna and instructions for building your own basket weave coil mandrel. The secret life of detectors is revealed in John Davidson's seminal article presented here with parts 1 and 2 together. 8 1/2 X 11, Comb bound. Cat # xv15 $12.95

Crystal Radio: From Galena to Litz Volumes16-17 of the Xtal Set Newsletters

Just when you thought the projects were over, here's a new batch. Again society members bring you ideas and instructions for a variety of crystal radio projects. These are gathered from the 2006 & 2007 newsletters! H.P. Friedrichs introduces his "Tea Time" Headphones (constructed in a pair of little tea boxes). There's a variable-coupled basket weave coil, Dan's Fruit of the Loom Set (a basket of Litz of course), Mike's 1-Tube Low Voltage DXer Set (3Q4), stuff about Toroids, Patron's Modern Armstrong Regen RX, stuff on detection, Spider coils from Dan, the Xtal High Voltage Contest Entry winner, a calibrated capacitor, Phil's Crazy-L Attic Antenna, Alex Jueschke's homebrew loopstick coils (from magnet ore sweepings), a rare picture of Joe Eisenberg of Nebraska (!), another regen rig, Phil's crazy AM Chopper Modulator, a sampling of member correspondence, and more! 8-1/2 by 11, 100 pages, Comb bound.Cat# XV17 $15.95

Crystal Set Society Newsletter Volume 18 and 19

Learn about using audio transformers from Phil, building a basic grid leak from Dan, and how to build a homemade flame triode from Nyle Steiner. These ideas and many others are from the 2008-2009 newsletters. In the 2009 section, you will see Dan's one-FET set, and an antenna tuner for your crystal radio. Dennis Baker shows us a radio on a stick. 8 ½ by 11 with 118 pages, Comb Bound. XV19 $16.95.

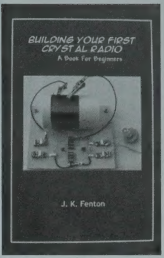
Antennas, Tubes and Regeneration, Volumes 20 and 21

This edition marks 20 years of the Crystal Set Society. Many thanks to all our members for twenty years of fun with radio. The compilation includes the articles from the 2010 and 2011 newsletters, including: Fun With Homebrew Cuprous Oxide Diodes; Resistance of Hardboard; The Telefunken Crystal Set; Two Popular AM Loop Antennas; Diode Biasing; Ultrasound Pressure of a Weak Spark; The Old Timer - Regeneration; The Antenna Tutorial I, II & III; Crystal Radios Are Like Beer; A Trap Antenna; Simple Circuits for Quality Sound; Audio Regeneration; Powered by Fleming's Amazing Valve; Two JFET Crystal Sets, From the Mailbox of Prof Verruckt, The AM Antenna Tuner Kit, and more. 8-½ by 11 with 115 pages, Comb Bound. Cat#XV21 $16.95.

Building your First Crystal Radio by J.K. Fenton

This small booklet is written in easy to read language for the true beginner to our wonderful hobby. It has pictures and symbols for basic parts and gives the reader basic information to get started with that first building project. 5 1/2 X 8 1/2 15 pgs

Cat# XBGN $2.95.



ORDER FORM (5/2013)

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VISA MC Card# EXP			
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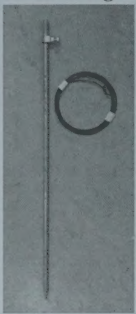
Orders are filled promptly, but allow 2-3 weeks for delivery			

Xtal Set Society ◆ PO Box 3636, Lawrence KS 66046 ◆ 405-517-7347 ◆ xtalset@sunflower.com
www.midnightscience.com

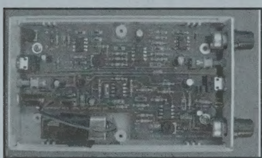
Grounding Kit



This kit is ideal for use with our Crystal Radio Antenna Kit or for general station grounding. It consists of a long-lasting 2.5 by 1/2 inch galvanized ground rod, 1/2-inch brass rod clamp, ten feet of #14 Insulated Stranded copper antenna wire and an instruction/installation sheet. The grounding kit provides for an outside grounding circuit for your crystal radio. The antenna wire is very flexible, allowing you to loop it under your window at the sill and then simply closing the window.

Grounding Kit Catalog # Grd-K $19.95.

CW REGEN FILTER, (Alias: The Scrubber)



This kit was inspired by the inhibiting galactic noise encountered when listening to HF CW. Many proficient CW operators turn the AF gain full on and manage the audio signal and noise with internal rig filters and the RF gain knob. Even with these techniques band-limited cosmic static is present along with some man-made noise. There isn't much one can do to copy CW notes that are simply too weak; but, one can scrub away a portion of the static that makes its way into our consciousness with an audio regenerative filter. (See the feature article on the CW Scrubber in November, 2012 CQ Magazine.)

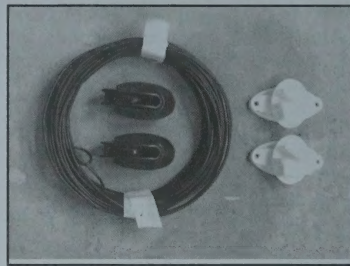
For example, when tuned to a quiet spot on 30-meters, regen's output shows a reduction in noise compared to the signal at the phone jack of the receiver. In bypass mode one simply listens to what the rig has to offer. In scrubber mode, the multiple-op-amp filters and regen work together to remove a majority of the remaining white noise. The processed signal sounds clean with a slight echo-chamber quality. For most this is an improvement, reducing stress and improving copy.

For experienced kit makers, assembly and alignment is about two hours. You can use a meter or scope to align the filters and the audio delay line. If you have neither of these you can align the filter by ear. If you don't have a signal generator, you can use CW from your rig, a code oscillator or download 600, 700, and/or 800 Hz wavefiles from our "downloads" webpage. In addition, you'll supply the connectors and cabling for your specific radio and the following tools and supplies: pliers, cutters, knife or wire stripper, soldering iron & solder, masking tape and your enthusiasm! The filter can be supplied with a well regulated and grounded +12VDC supply or 9V battery. A well grounded station is necessary when external high gain audio-based accessories are added to prevent or substantially reduce any "ground loop" interference. The populated PCB fits in a plastic case that is W 3.700, H 1.450, and L 6.100 inches.

CW REGEN FILTER KIT, PCB & MANUAL ONLY 29.95
CW REGEN FILTER KIT, NO CASE 49.95
CW REGEN FILTER KIT WITH CASE 69.95

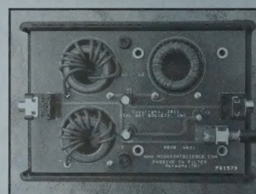
Crystal Radio Antenna Kit

This kit consists of 50 feet of #14 AWG insulated and stranded copper antenna wire, two nail insulators, two antenna insulators and an instruction and installation sheet. The instruction sheet outlines how to install the antenna for the AM band.



The nail insulators mount with two wood screws and provide for wire support near the window and at a tree or eve. Weave the wire through the "claws" of the nail insulator to hold it in place. The antenna insulators may be used with rope on one side and as a tie-off for the antenna wire on the other side. These are shown in the picture inside the 50' loop of wire. Since the wire is flexible, you can easily place it on your window sill and close the window. Crystal Radio Antenna Kit Cat #Ant-k $19.95

Passive Audio CW Filter Kit



Our Passive Audio CW Filter Kit was inspired by our enthusiasm for non-powered – no batteries or power supplies required – electronics. The kit features a 250 Hertz (Hz) bandwidth, 700 Hz center-frequency, 8-ohms in, 8-ohms out audio filter, designed for CW operation. A bypass switch allows for bypass and in-line reception comparison. The unit installs between your receiver's headphone jack and headphones or speaker. Assembly for experienced kit builders is less than an hour. The kit consists of eleven parts, including three high-mu ferrites, quality PCB and black plastic case. Instructions are included for changing the filter bandwidth to 500 Hz for CW or 1500 Hz for SSB; for either of these frequency bandwidths the number of winding per core must be changed and a different set of capacitors purchased.

The kit can accommodate other center frequencies and bandwidths. To calculate the number of turns for the cores (coils) and the capacitor values required download these files: manual addendum and filter calculator spread sheet (xls).

Passive Audio CW Filter Kit, with PCB & CASE 36.95